Winter pea as a Cover Crop before Corn

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Objective

With high grower interest in using winter pea as a cover crop and potential nitrogen provider, multiple objectives were undertaken.

- To determine corn yield response to winter pea as a cover crop planted at different dates.
- To determine optimum nitrogen rate for corn grown after a winter pea cover crop.
- To determine the optimum winter pea cover crop planting date for maximum nitrogen contribution to a corn crop.
- To determine hybrid differences for N uptake by cover crop planting date.

Background

Crop Year:	2011	Tillage:	none
Location:	OARDC Western Ag Research Station	Soil Test:	pH 6.1, BpH 6.6, P 34ppm, K 184 ppm, CEC 18.5
County/Town:	Clark, So. Charleston	Planting Date:	June 3, 2011
Soil Type:	Crosby silt loam	Nitrogen:	varies by treatment
Drainage:	Pattern tiled	Seeding Rate:	32,097 seed/A
Previous Crop:	Winter wheat	Harvest Date:	November 10, 2011

Methods

Corn grain yield is used as the measure of cover crop and nitrogen effects. This study was designed as a randomized complete block, with winter pea cover crop as the main block, split by nitrogen rate, and then split by hybrid with four replications. The trial was conducted at the OARDC Western Agricultural Research Station near South Charleston, Ohio in 45 by 15 foot plots for each nitrogen (N) treatment. Six 30-inch rows were planted for each nitrogen rate with a John Deere 1750 no-till planter; the planter was split with two corn hybrids. Two rows were harvested for yield from each split-planter plot. Herbicides used in the plot area included an at plant application of glyphosate, Bicep Magnum, Calisto and 2,4-D followed by an in-crop application of glyphosate.

Variables evaluated:

1. Winter pea planting date –
    - No cover crop (wheat stubble), August 25, September 10 or September 24 of 2010.
2. Nitrogen (N) rate – 0, 75, 150 or 225 lb N/A
    - For N rates 75, 150 & 225 – 75 lb N/A was included through the planter as urea, the remainder as 28% was applied June 30.
3. Hybrids – Seed Consultants SC1119 or SC11HQ38.

Winter pea was planted the previous fall with a ten-foot Great Plains no-till drill at thirty pounds of seed per acre at 1.25 inches deep. Planting dates were chosen based on previous experience.

The drill was also operated without seed through the no cover (wheat stubble only) plots to simulate a minimum tillage pass equivalent to that of the planted plots. The concern was that planter tillage may be a factor in cover crop response.

With the corn crop planting following wheat and the actual nitrogen contribution of the winter pea unknown, an N rate similar to that recommended for corn following wheat was used as the highest rate.

Two hybrids were used to evaluate nitrogen uptake over a range of genetics. Company provided information indicated that one hybrid prefers front loaded N applications and the other grows well with late applied N.

A plot harvester, the Massey Ferguson model 8XP combine, was used to harvest two rows of each three-row plot and grain was weighed and moisture determined with a mounted digital scale for on-the-go harvest. Yield was corrected for moisture content.

Results

Main effects are presented first, then significant interaction effects. Table 1 presents planting dates effects, Table 2 nitrogen effects and Table 3 the hybrid effects.

Table 1. Cover effects on corn yield, 2011 winter pea study.

Cover crop	Yield (bu/A)
None (wheat stubble)	152.0
Pea planted 8/25/10	163.7
Pea planted 9/10/10	154.4
Pea planted 9/24/10	170.7
LSD (0.10)	**NSD**

Table 2. Nitrogen rate effects on corn yield, 2011 winter pea study.

Nitrogen rate (lbs N/A)	Yield (bu/A)
0	93.4
75	146.2
150	192.6
225	208.6
LSD (0.10)	**5.1**

Table 3. Hybrid effects on corn yield, 2011 winter pea study.

Hybrid	Yield (bu/A)
Seed Consultants SC1119	153.3
Seed Consultants SC11HQ38	167.1
LSD (0.10)	**3.2**

Significant interaction effects occurred only for cover by nitrogen rate and are presented here in Table 4.

Table 4. Cover by nitrogen rate interaction effects on corn yield in bu/A, 2011 winter pea study.

N rate	No cover wheat stubble	W. pea 25-Aug	W. pea 10-Sep	W. pea 24-Sep
0	81.0	94.7	88.2	109.9
75	132.5	157.0	139.2	156.0
150	184.1	194.7	191.3	200.5
225	210.5	208.4	198.8	216.6
LSD (0.10) across cover by N				**10.3**

Summary

Our greatest interest was in producing nitrogen by growing an annual legume – winter pea. As noted in Table 1, there were no significant differences by winter pea treatment and corn following wheat stubble alone generated yield equal to any of the pea planting dates (p= 0.28).

Our second concern was the required nitrogen rate to maximize yield. As noted in Table 2, increasing nitrogen rates did increase yield. With the highest rate (225 lb N/A) required for maximum yield ($p < 0.0001$). This is similar to an N rate required after winter wheat in the rotation.

Shown in Table 3 is our third interest, hybrid difference. In this trial Seed Consultants SC11HQ38 significantly out yielded it's companion SC1119 ($p < 0.0001$). We anticipated a cover by hybrid interaction, but that did not occur.

Table 4 shows our interaction effects. In this trial only the interaction between cover crop and nitrogen rate was of concern. Yield of corn for winter pea planted at either August 25th or September 24th had greater yield than the check treatment of wheat stubble at 0, 75 and 150 lb N/A (p= 0.09). This is what we might expect if winter pea was contributing nitrogen to the corn, but somewhat surprising is that the September 10 winter pea planting date does not respond with higher corn yield. Reports from co-workers were that the winter pea cover would provide 75 lb N/A to the succeeding crop. It does not appear to be the case that the pea provided as much nitrogen as that, but perhaps a lesser amount, obvious here by comparing 150 N rates across the cover crop planting dates to the 225 N rate. As to why there was a difference by planting date; that is confusing and shows that cover crops can be inconsistent in their value to the succeeding crop.

There was a significant interaction for N rate by hybrid ($p = 0.0002$), as expected, that will not be discussed now but held for a separate report. There was no 3-way interaction of cover by N rate by hybrid.

Over the approximately six years that this investigator has conducted trials with cover crops, the seed price of winter pea, for example, has risen from $0.50 per pound to $1.00 or more. The seed cost to plant winter pea rose from $15 per acre in 2006 to over $30 in 2012. Corn price over this period rose from $2.28 to $6.67, so perhaps the price increase in cover crop seed was justified,

however unpredictable and inconsistent results in yield increase for the succeeding corn crop must call into question the value of winter pea as a cover crop for economic reasons alone.

One final note, due to a mild winter (2010-11) all plantings of winter pea survived without significant winter kill and continued growth in the spring until terminated by herbicides at corn planting on June 3rd. Little difference in stands of winter pea were noted across the planting dates. Previous observations with winter pea indicated August and early September planting dates saw near total winter kill, while late September planting dates (from 21st to 24th) led to reduced fall growth but good winter hardiness and continued spring growth up to corn planting timing.

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